Police officer in charge of a Police station, or by any Police officer of higher rank.

(G. I., H. D., Notn. No. 1393, dated 8th July 1897; *vide* G. N. No. 5283, dated 14th idem.)

RULE FOR TESTING EXPLOSIVES.

2. With reference to Rule 14 of the rules to regulate the transport and importation of explosives published with Home Department Notification No. 1393, dated the 8th July 1897, the Governor-General in Council is pleased to make the following rule on the subject of the tests which explosives should be required to pass before their importation is permitted:—

Rule.

Class 1.—Gunpowder class. Gunpowder is not required to pass a test.

Class 2.—Nitrate-mixture class. Nitrate-mixture explosives are not ordinarily required to pass a test. The Local Government, however, or the authorized officer granting the import license under Rule 13 of the Rules to regulate the transport and importation of explosives published with Home Department Notification No. 1393, dated the 8th July 1897, may in any particular case or class of cases require that a sample of the explosive which is to be imported be sent first to the Chemical Examiner for an analysis of its constituent parts.

Class 3.—Nitro-compound class. It is for explosives of this class that testing is chiefly required, in respect to the purity of their composition and their liability to liquefaction or exudation. The tests prescribed for nitro-compound explosives are contained in Schedule A attached to this rule.

Class 4.—Chlorate-mixture class. See Schedule A for remarks regarding the testing of this class*.

Class 5.—Fulminate class. No test has been laid down for explosives of the Fulminate class.*

Class 6.—Ammunition class. No test is required for explosives of the 1st division of this class. If the substances of which explosives of the 2nd and 3rd divisions are composed have to be tested under the preceding rules, they will be equally liable to be tested when enclosed in any case or contrivance and thus falling under the Ammunition class.

Class 7.—Firework class. Explosives of this class are not required to pass a test.

SCHEDULE A.

HEAT TEST AS APPLIED TO EXPLOSIVES OF THE NITRO-COMPOUND CLASS.

GENERAL INSTRUCTIONS.

Apparatus required.

1. A water bath, consisting of a spherical glass or copper vessel [(*a*) Fig. I] of about 8 inches

* Licenses are not at present given for the importation into British India of any explosives of these classes.

diameter, and with an aperture of about 5 inches; the bath is filled with water to within a quarter of an inch of the edge. It has a loose cover of sheet copper about 6 inches in diameter (*b*), and rests on a tripod stand about 14 inches high (*c*), which is covered with coarse iron wire gauze (*e*), and is surrounded with a screen of thin sheet tin or copper (*d*). Within the latter is placed an Argand burner (*f*), with glass chimney. The cover (*b*) has four holes arranged as seen in Fig. II, No. 4 to receive the regulator, No. 3 the thermometer, Nos. 1 and 2 the test-tubes containing the gun-cotton or other materials to be tested. Around holes 1 and 2 on the under side of the cover are soldered three pieces of brass wire with points slightly converging (Fig. III); these act as springs and allow the test-tubes to be easily placed in position and removed.

Fig. I.

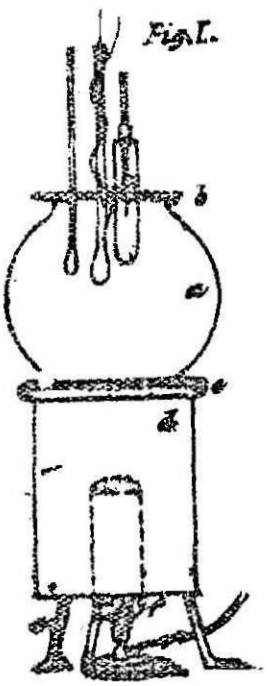


Fig. II.

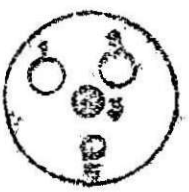


Fig. III.

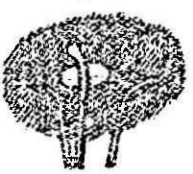


Fig. IV.

* 2. Scheibler's or Page's temperature regulator.

* 3. Two cells of Le Clanché's battery No. 1.
* 4. A few yards of insulated copper wire.
} if Scheibler's regulator is used.

5. Test tubes from 5¼ to 5½ inches long, and of such diameter that they will hold from 20 to 22 cubic centimeters of water when filled to a height of 5 inches.

6. India-rubber stoppers, fitting the test-tubes and carrying an arrangement for holding the test-paper, *viz.*, a narrow glass tube passing through the centre of the stopper, drawn out so as to form a hook, or terminating in a platinum wire hook (Fig. IV).

7. A thermometer, with range not less than from 30° to 212° Fahrenheit.

8. A minute clock.

* This is not absolutely required, as the temperature of the bath can be kept constant by proper attention to the heating flame.

Materials required.

(*a.*) *Test-paper.*—The test-paper is prepared as follows :—45 grains of white maize starch (cornflour), previously washed with cold water, are added to 8½ ounces of distilled water ; the mixture is stirred, heated to boiling, and kept gently boiling for 10 minutes ; 15 grains of pure potassium iodide (*i.e.*, which has been recrystallized from alcohol) are dissolved in 8½ ounces of distilled water. The two solutions are thoroughly mixed and allowed to get cold. Strips, or sheets, of white English filter paper previously washed with water and redried, are dipped into the solution thus prepared, and allowed to remain in it for not less than 10 seconds ; they are then allowed to drain and dry in a place free from laboratory fumes and dust. The upper and lower margins of the strips, or sheets, are cut off, and the paper is preserved in well-stoppered or cork, bottles, and in the dark.* The dimensions of the pieces of test-paper used are about $\frac{4}{10}$ inch by $\frac{8}{10}$ inch (10 mm. by 20 mm.).

(*b.*) *Standard tint paper.*—A solution of caramel in water is made of such concentration that when diluted one hundred times (10 cc. made up to 1 litre), the tint of this diluted solution equals the tint produced by the Nessler test in 100 cc. water containing 0·000075 grm. of ammonia or 0·00023505 grm. of chloride of ammonium. With this caramel solution lines are drawn on strips of white filter paper† by means of a clean quill-pen. When the marks thus produced are dry, the paper is cut into pieces of the same size as the test-paper previously described, in such a way that each piece has a brown line across it near the middle of its length, and only such strips are preserved in which the brown line has a breadth varying from ½ mm. to 1 mm. ($\frac{1}{50}$th of an inch to $\frac{1}{25}$th of an inch).

1.—TESTING DYNAMITE, BLASTING GELATINE, AND OTHER EXPLOSIVE OF THE FIRST DIVISION OF THE NITRO-COMPOUND CLASS.

A.—DYNAMITE, ETC., ETC.

Nitro-glycerine preparations, from which the nitro-glycerine can be extracted in the manner described below, *must* satisfy the following test, otherwise they will not be considered as manufactured

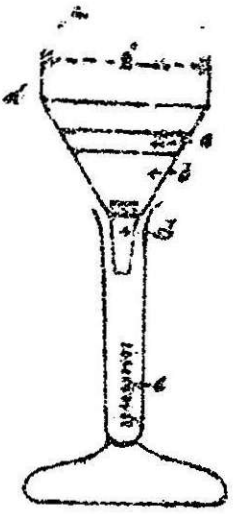
* When a paper is freshly prepared, and as long as it remains in good condition, a drop of dilute acetic acid put on the paper with a glass rod, produces no coloration. In process of time, however, the stronger the light to which the paper is exposed, the sooner a drop of the acid produces a brown or bluish coloration (a single hour of direct sunlight produces a marked effect), and whenever this is the case, the paper should be rejected. On this account it is advisable not to prepare too much of the test-paper at one time, but to prepare it fresh every month or so.

† This paper must be carefully washed with distilled water in the first instance, to remove any traces of bleaching matter and dried.

with "thoroughly purified nitro-glycerine" within the terms of the license.*

Apparatus required.

A funnel 2 inches across (*d*), a cylindrical measure divided into grains (*e*). (*See* sketch.)



Mode of Operation.

About 300 to 400 grains of dynamite (*b*) finely divided are placed into the funnel, which has previously been loosely plugged by some freshly-ignited asbestos (*a*).

The surface is smoothed by means of a flat-headed glass rod or stopper, and some clean washed and dried Kieselguhr (*c*) is spread over it to the depth of about $\frac{1}{8}$ inch.

Water is next carefully dropped from a wash bottle upon this Kieselguhr, and when the first portion has been soaked up, more is added; this is repeated until sufficient nitro-glycerine has been collected in the graduated measure (*e*) below.

If any water should have passed through with the nitro-glycerine, it should be removed with a piece of blotting paper, and the nitro-glycerine, if necessary, filtered through a dry paper filter.

Application of the Test.

The thermometer is fixed so as to be inserted through the lid of the water bath described under I, page 422, into the water (which is to be steadily maintained at a temperature of 160° Fahr.) to a depth of $2\frac{3}{4}$ inches. Fifty grains of nitro-glycerine to be tested, are weighed into a test-tube in such a way as not to soil the sides of the tube. A test-paper is

* This test, though at present looked upon as the most important, as far as testing the purity of the nitro-glycerine is concerned, is in England only one of several which any given sample of nitro-glycerine preparation has to satisfy in order to establish its compliance with the definition in the license.

fixed on the hook of the glass rod so that, when inserted into the tube it will be in a vertical position. A sufficient amount of a mixture of half distilled water and half glycerine to moisten the upper half of the paper is now applied to the upper edge of the test-paper, by means of a camel's-hair pencil, the cork carrying the rod and paper is fixed into the test-tube and the position of the paper adjusted, so that its lower edge is about half-way down the tube; the latter is then inserted through one of the perforations of the cover to such a depth that the lower margin of the moistened part of the paper is about five-eighths of an inch above the surface of the cover. The test is complete when the faint brown line which after a time makes its appearance at the line of boundary between the dry and moist part of the paper equals in tint the brown line of the standard tint paper.

The nitro-glycerine under examination will not be considered as "thoroughly purified" within the terms of the license unless the time necessary to produce the standard tint as above described is at least 15 minutes.

B.—BLASTING GELATINE, GELATINE DYNAMITE, AND ANALOGOUS PREPARATIONS.

Fifty (50) grains of blasting gelatine are to be intimately incorporated with one hundred (100) grains of French chalk.* The mixture is to be gradually introduced into a test-tube of the dimensions prescribed above for the dynamite heat test, with the aid of gentle tapping upon the table, between the introduction of successive portions of the mixture into the tube, so that when the tube contains all the mixture it shall be filled to the extent of $1\frac{3}{4}$ inches (one inch and three-quarters) of its height. The test-paper is then to be inserted and the heat is to be applied in the manner prescribed above for the dynamite heat test, and the sample tested is to withstand exposure to 160° Fahr. for a period of (10) ten minutes before producing a discoloration of the test-papers corresponding in tint to the standard colour test which is employed for governing the results of the dynamite heat test.

(For Exudation and Liquefaction tests for Blasting Gelatine, etc., etc., see Appendix, p. 429.)

N.B.—Non-gelatinized nitro-glycerine preparations, from which the nitro-glycerine cannot be expelled by water, are tested without any previous separation of the ingredients, the temperature being as above (160° Fahr.) and the time being seven (7) minutes.

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* This can be readily effected by carefully working the two materials together with a wooden pestle in a wooden mortar.

The French chalk should be of good commercial quality, and after being carefully washed with distilled water and dried in a water oven, it should be exposed under a bell jar to moist air until it has taken up about 0·5 per cent. of moisture. It should then be bottled for use; and with ordinary care the limits of 0·5 per cent. can be maintained in keeping.

C.—CORDITE AND BALLISTITE.

1. *Apparatus required.*

The apparatus necessary for the application of the heat test to cordite is identical with that described above (see page 422) for explosives of the nitro-compound class generally* with the addition of a mill and a nest of sieves similar to those used at Waltham Abbey for preparing the cordite for testing (see instructions below).

2. *Preparation of the sample to be tested.*

Pieces half an inch long are cut from one end of every stick selected for the test; in the case of the thicker cordites, each piece so cut is further subdivided into about four portions. These cut pieces are then passed two or three times through the mill, the first portion of material which passes through being rejected on account of the possible presence of foreign matter from the mill. The ground material is put on the top sieve of the nest of sieves and sifted. That portion which has passed through the top sieve and been stopped by the second is taken for the test. After each sample has been ground, the mill must be taken to pieces and carefully cleaned.

3. *Application of the Test.*

The thermometer is fixed so as to be inserted through the lid of the water bath, described under I, page 422, so as to be immersed in the water to a depth of $2\frac{3}{4}$ inches. The water is maintained at a constant temperature of 180° Fahr. When this temperature is reached, 25 grains of the sifted cordite are put into one of the test-tubes, and collected at the bottom by gentle tapping. A test-paper is fixed on to the hook of the glass rod, so that when inserted into the tube it will be in a vertical position. A mixture of equal parts of distilled water and pure glycerine (Price's) is now applied to the upper edge of the test-paper by means of a camel's-hair pencil, in sufficient amount to moisten the upper half; the stopper carrying the rod and paper is fixed into the test-tube and the position of the paper adjusted so that its lower edge is about half-way down the tube; the latter is then inserted through one of the perforations of the cover to the same depth as the thermometer. The lower margin of the moistened part of the paper should then be about five-eighths of an inch above the surface of the cover. The test is completed when the faint brown line, which after a time makes its appearance at the margin between the wet and dry portions of the test-paper, equals in depth of tint the brown line drawn on the standard tint paper.

4. The time which elapses between the insertion of the test-tube and the completion of the test must not be less than 15 minutes.

* In the Waltham Abbey apparatus the cover (Fig. II) has all the holes around the circumference, instead of having one in the centre and three around the circumference.

N.B.—In the case of ballistite the treatment is the same, except that when it is in a very finely granulated condition it need not be cut up.

II.—TESTING GUN-COTTON, SCHULTZE GUNPOWDER, E. C. POWDER, AND OTHER EXPLOSIVES OF THE 2ND DIVISION OF THE NITO-COMPOUND CLASS.

A.—GUN-COTTON, TONITE, ETC., ETC.

Sufficient material to serve for two or more tests is removed from the centre of the cartridge by gentle scraping, and, if necessary, further reduced by rubbing between the fingers.

The fine powder thus produced is spread out in a thin layer upon a paper tray 6 inches by 4½ inches, which is then placed inside a water oven, kept, as nearly as possible, at 120° Fahr.

The wire gauze shelves in the oven should be about 3 inches apart. The sample is allowed to remain at rest for 15 minutes in the oven, the door of which is left wide open.

After the lapse of 15 minutes the tray is removed and exposed to the air of the room for two hours, the sample being at some point within that time rubbed upon the tray with the hand, in order to reduce it to a fine and uniform state of division.

Application of the Test.

The cover of the water bath is fitted with the gas regulator which is inserted through the centre hole (No. 4). The thermometer is fixed into hole No. 3. The water in the bath is then heated to 170° Fahr., and the regulator set to maintain that temperature. Twenty grains of the sample to be tested are weighed out, placed in the test-tube, and gently pressed down until the specimen occupies a space of as nearly as possible $1\frac{5}{16}$ inches in a test-tube of the dimensions specified. A test-paper is affixed to the hook of the glass rod or tube, and moistened by touching the upper edge with a drop of distilled water containing 50 per cent. of Price's glycerine. The quantity of liquid used must be only sufficient to moisten about half of the paper. The cork carrying the rod and test-paper is then fixed into the test-tube, and the latter inserted into the bath to a depth of 2½ inches, measured from the cover, the regulator and thermometer being inserted to the same depth. The test-paper is to be kept near the top of the test-tube, but clear of the cork until the tube has been immersed for about five minutes. A ring of moisture will about this time be deposited upon the sides of the test-tube a little above the cover of the bath; the glass rod must then be lowered until the lower margin of the moistened part of the paper is on a level with the bottom of the ring of moisture in the tube; the paper is now closely watched. The test is complete when a very faint brown coloration makes its appearance at the line of boundary between the dry and moist parts of the paper.

The interval of time between the first insertion of the tube containing the sample of gun-cotton in the water at 170 and the first appearance of discoloration on the paper constitutes the test, and this interval of time must be not less than 10 minutes, or the sample will not be accepted as properly purified.

*B.—Gelatinized Gun-cotton Preparations.**

Twenty-five grains introduced into test-tube of the dimensions prescribed for the dynamite heat test, then proceed as for Blasting Gelatine, etc., taking the temperature at 180° Fahr., and the time as 15 minutes.

C.—Schultze Powder, E. C. Powder, Collodion Cotton, etc., etc.

Sufficient of the sample, without further mechanical division, is dried in the oven as above, and then exposed for two hours to the air. The test as directed above for Compressed Gun-cotton, etc., is then applied, the minimum duration of test being the same, *viz.*, 10 minutes.

D.—Picric Acid.

(1) The material shall contain not more than 0·3 part of mineral or non-combustible matter in 100 parts by weight of the material dried at 160° Fahr.

(2) One hundred parts of the dry material shall not contain more than 0·3 part of total (free and combined) sulphuric acid, of which not more than 0·1 part shall be free sulphuric acid.

(3) Twenty grains of the material shall stand the heat test as laid down for dynamite (see *ante*, p. 423) for not less than 15 minutes.

E.—Ammonite, Bellite, Roburite, and Explosives of similar Composition.

These are required to stand the same heat test as gun-cotton (see *ante*, p. 427.)

III.—TESTING CHLORATE MIXTURES.

No tests have yet been laid down, as at present there are no authorized explosives of this class, but in the event of any being authorized, it would be necessary to require that they should satisfy the heat test laid down for gun-cotton, and from time to time the degree of sensitiveness to percussion or friction (especially a glancing blow) should be observed.

* If in a compressed form it should be broken up in the same manner as cordite and ballistite.